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INSTITUTES OF ANTHROPOLOGY[1]

THE anthropological problems of the present day are so numerous and so pressing that we can afford to select those of the greatest utility. Indeed, the three university institutes of anthropology I have suggested would have to specialize and then work hard to keep abreast of the problems which will crowd upon them. One might take the European races, another Asia and the Pacific, and a third Africa. America in anthropology can well look after itself. In each case we need something on the scale of the Paris Ecole d'Anthropologie, with its seventeen professors and teachers, with its museums and journals. But we want something else—a new conception of the range of problems to be dealt with and a new technique. From such schools would pass out men with academic training fit to become officials, diplomatic agents, teachers, missionaries, and traders in Europe, in Asia or in Africa, men with intelligent appreciation of and sympathy with the races among whom they proposed to work.

But this extra-state work, important as it is, is hardly comparable in magnitude with the intra-state work which lies ready to hand for the anthropological laboratory that has the will, the staff and the equipment to take it up efficiently. In the present condition of affairs it is only too likely that much of this work, being psychometric, will fall into the hands of the psychologist, whereas it is essentially the fitting work of the anthropologist, who should come to the task, if fitly trained, with a knowledge of comparative material and of the past history, mental and physical, of mankind, on which his present faculties so largely depend. The danger has

[1] Concluding part of the address of the president of the Anthropological Section of the British Association for the Advancement of Science, Cardiff, 1920.

arisen because the anthropometer has forgotten that it is as much his duty to measure the human mind as it is his duty to measure the human body, and that it is as much his duty to measure the functional activities of the human body—its dynamical characters—as its statical characters. By dynamical characters I understand such qualities as resistance to fatigue, facility in physical and mental tasks, immunity to disease, excitability under stimuli, and many kindred properties. If you tell men that we are here trenching on the field of psychology and medicine, I reply: Certainly; you do not suppose that any form of investigation which deals with man—body or mind—is to be omitted from the science of man? If you do you have failed to grasp why anthropology is the queen of the sciences. The university anthropological institute of the future will have attached to it a psychologist, a medical officer and a biologist. They are essential portions of its requisite staff, but this is a very different matter from lopping off large and important branches of its fitting studies, to lie neglected on the ground, or to be dragged away, as dead wood, to be hewn and shapen for other purposes by scientific colleagues in other institutes. Remember that I am emphasizing that side of anthropology which studies man in the service of the state—anthropology as a utile science—and that this is the only ground on which anthropology can appeal for support and sympathy from state, from municipality, and from private donors. You will notice that I lay stress on the association of the anthropological institute with the university, and the reasons for this are manifold. In the first place, every science is stimulated by contact with the workers in allied sciences; in the second place, the institute must be a teaching as well as a researching body, and it can only do this effectively in association with an academic center—a center from which to draw its students and to recruit its staff. In the third place, a great university provides a wide field for anthropometric studies in its students and its staff. And the advantages are mutual. It is not of much service to hand a student a card containing his stature, his weight, his eye color, and his head length! Most of these he can find out for himself! But it is of importance to him to know something of how his eye, heart, and respiration function; it is of importance to him to know the general character of his mental qualities, and how they are associated with the rapidity and steadiness of muscular responses. Knowledge on these points may lead him to a fit choice of a career, or at any rate save him from a thoroughly bad choice.

In the course of my life I have often received inquiries from schoolmasters of the following kind: We are setting up a school anthropometric laboratory, and we propose to measure stature, weight, height sitting, etc. Can you you suggest anything else we should measure?

My invariable reply is: Don't start measuring anything at all until you have settled the problems you wish to answer, and then just measure the characters in an adequate number of your boys, which will enable you to solve those problems. Use your school as a laboratory, not as a weighhouse.

And I might add, if I were not in dread of giving offence: And most certainly do not measure anything at all if you have *no* problem to solve, for unless you have you can not have the true spirit of the anthropologist, and you will merely increase that material up and down in the schools of the country which nobody is turning to any real use.

Which of us, who is a parent, has not felt the grave responsibility of advising a child on the choice of a profession? We have before us, perhaps, a few meager examination results, an indefinite knowledge of the self-chosen occupations of the child, and perhaps some regard to the past experience of the family or clan. Possibly we say John is good with his hands and does not care for lessons; therefore he should be an engineer. That may be a correct judgment if we understand by engineer, the engine-driver or mechanic. It is not true if we think of the builders of Forth Bridges and Assuan Dams. Such men

work with the head and not the hand. One of the functions of the anthropological laboratory of a great university, one of the functions of a school anthropometric laboratory, should be to measure those physical and mental characters and their inter-relations upon which a man's success in a given career so much depends. Its function should be to guide youth in the choice of a calling, and in the case of a school to enable the headmaster to know something of the real nature of individual boys, so that that much-tried man does not feel compelled to hide his ignorance by cabalistic utterances when parents question him on what their son is fitted for.

Wide, however, as is the anthropometric material in our universities and public schools, it touches only a section of the population. The modern anthropologist has to go further; he has to enter the doors of the primary schools; he has to study the general population in all its castes, its craftsmen, and its sedentary workers. Anthropology has to be useful to commerce and to the state, not only in association with foreign races, but still more in the selection of the right men and women for the staff of factory, mine, office and transport. The selection of workmen to-day by what is too often a rough trial and discharge method is one of the wasteful factors of production. Few employers even ask what trades parents and grandparents have followed, nor consider the relation of a man's physique and mentality to his proposed employment. I admit that progress in this direction will be slow, but if the work undertaken in this sense by the anthropologist be well devised, accurate, and comprehensive, the anthropometric laboratory will gradually obtain an assured position in commercial appreciation. As a beginning, the anthropologist by an attractive museum, by popular lectures and demonstrations, should endeavor to create, as Sir Francis Galton did at South Kensington, an anthropometric laboratory frequented by the general population, as well as by the academic class. Thus he will obtain a wider range of material. But the anthropologist, if he is to advance his science and emphasize its services to the state, must pass beyond the university, the school, and the factory. He must study what makes for wastage in our present loosely organized society; he must investigate the material provided by reformatory, prison, asylums for the insane and mentally defective; he must carry his researches into the inebriate home, the sanatorium, and the hospital, side by side with his medical collaborator. Here is endless work for the immediate future, and work in which we are already leagues behind our American colleagues. For them the psychometric and authropometric laboratory attached to asylum, prison, and reformatory is no startling innovation, to be spoken of with bated breath. It is a recognized institution of the United States to-day, and from such laboratories the "fieldworkers" pass out, finding out and reporting on the share parentage and environment have had in the production of the abnormal and the diseased, of the antisocial of all kinds. Some of this work is excellent, some indifferent, some perhaps worthless, but this will always be the case in the expansion of new branches of applied science. The training of the workers must be largely of an experimental character, the technique has to be devised as the work develops. Instructors and directors have to be appointed, who have not been trained *ad hoc*. But this is remedying itself, and if indeed, when we start, we also do not at first limp somewhat lamely along these very paths, it will only be because we have the advantage of American experience.

There is little wonder that in America anthropology is no longer the stepchild of the state. It has demanded its heritage, and shown that it can use it for the public good.

If I have returned to my first insistence that the problems handled by the anthropologist shall be those useful to the state, it is because I have not seen that point insisted upon in this country, and it is because my first insistence, like my third, involves the second for its effectiveness—the establishment in our chief universities of anthropological institutes. As Gustav Schwalbe said of an-

thropology in 1907—and he was a man who thought before he spoke, and whose death during the war is a loss to anthropologists the whole world over—"a lasting improvement can only arise if the state recognizes that anthropology is a science preeminently of value to the state, a science which not only deserves but can demand that chairs shall be officially established for it in every university. . . . Only this spread of officially authorized anthropology in all German universities can enable it to fulfil its task, that of training men who, well armed with the weapon of anthropological knowledge, will be able to place their skill at the service of the state, which will ever have need of them in increasing numbers."[2]

Our universities are not, as in Germany, government-controlled institutions, although such control is yearly increasing. Here we have first to show that we are supporting the state before the state somewhat grudgingly will give its support to us. Hence the immediate aim of the anthropologist should be —not to suggest that the state should *a priori* assist work not yet undertaken, but to do what he can with the limited resources in his power, and when he has shown that what he has achieved is, notwithstanding his limitations, of value to the state, then he is in a position to claim effective support for his science.

I have left myself little time to place fairly before you my third insistence.

ADOPTION OF A NEW TECHNIQUE

What is it that a young man seeks when he enters the university—if we put aside for a moment any social advantages, such as the formation of lifelong friendships associated therewith? He seeks, or ought to seek, training for the mind. He seeks, or ought to seek, an open doorway to a calling which will be of use to himself, and wherein he will take his part, a useful part, in the social organization of which he finds himself a member. Much as we may all desire it, in the pressure of modern life, it is very difficult for the young man of moderate means to look upon the university training as something apart from his professional training. Men more and more select their academic studies with a view to their professional value. We can no longer combine this senior wranglership with the pursuit of a judgeship; we can not pass out in the classical tripos and aim at settling down in life as a Harley Street consultant; we can not take a D.Sc. in chemistry as a preliminary to a journalistic career. It is the faculties which provide professional training that are crowded, and men study nowadays physics or chemistry because they wish to be physicists or chemists, or seek by their knowledge of these sciences to reach commercial posts. Even the very faculty of arts runs the danger of becoming a professional school for elementary school teachers. I do not approve this state of affairs; I would merely note its existence. But granted it, what does anthropology offer to the young man who for a moment considers it as a possible academic study? There are no professional posts at present open to him, and few academic posts.[3] There is little to attract the young man to anthropology as a career. Is its position as a training of mind any stronger? The student knows if he studies physics or chemistry or engineering that he will obtain a knowledge of the principles of observation, of measurement, and of the interpretation of data, which will serve him in good stead whenever he has to deal with phenomena of any kind. But, alas! in anthropology, while he finds many things of surpassing interest, he discovers no generally accepted methods of attacking new problems, *quot homines, tot sententiæ*. The type of man we want in anthropology is precisely the man who now turns to mathematics, to physics and to astronomy—the man with an exact

[2] *Correspondenz Blatt*, Jahrg. XXXVIII., S. 68.

[3] In London, for example, there is a reader in physical anthropology who is a teacher in anatomy, and a professorship in ethnology, which for some mysterious reason is included in the faculty of economics and is, I believe, not a full-time appointment.

mind who will not take statements on authority and who believes in testing all things. To such a man anthropometry—in all its branches, craniometry, psychometry and the wide field in which body and mind are tested together under dynamic conditions—forms a splendid training, *provided* his data and observations are treated as seriously as those of the physicist or astronomer by adequate mathematical analysis. Such a type of man is at once repelled from our science if he finds in its text-books and journals nothing but what has been fitly termed "kindergarten arithmetic." Why the other day I saw a paper by a distinguished anthropologist an attempt to analyze how many individual bones he ought to measure. He adopted the simple process of comparing the results he obtained when he took 10, 20, 30 individuals. He was not really wiser at the end of his analysis than at the beginning, though he thought he was. And this, notwithstanding that the whole matter had been thrashed out scientifically by John Bernoulli two centuries ago, and that its soluton is a commonplace of physicist and astronomer!

How can we expect the scientific world to take us seriously and to treat anthropology as the equal of other sciences while this state of affairs is possible? What discipline in logical exactness are we offering to academic youth which will compare with that of the older sciences? What claim have we to advise the state until we have introduced a sounder technique and ceased to believe that anthropometry is a science that any man can follow, with or without training? As I have hinted, the problems of anthropology seem to me as subtle as those of physical astronomy, and we are not going to solve them with rusty weapons, nor solve them at all unless we can persuade the "brainy boys" of our universities that they are worthy of keen minds. Hence it seems to me that the most fertile training for academic purposes in anthropology is that which starts from anthropometry in its broadest sense, which begins to differentiate caste and class and race, bodily and mental health and disease, by measurement and by the analysis of measurement. Once this sound grounding has been reached the trained mind may advance to ethnology and sociology, to prehistory and the evolution of man. And I shall be surprised if equal accuracy of statement and equal logic of deduction be not then demanded in these fields, and I am more than half convinced, nay, I am certain, that the technique the student will apply in anthropometry can be equally well applied in the wider fields into which he will advance in his later studies. Give anthropology a technique as accurate as that of physics, and it will forge ahead as physics has done, and then anthropologists will take their due place in the world of science and in the service of the state.

Francis Galton has a claim upon the attention of anthropologists which I have not. He has been president of your institute, and he spoke just thirty-five years ago from the chair I now occupy, pressing on you for the first time the claims of new anthropological methods. In Galton's words: "Until the phenomena of any branch of knowledge have been submitted to measurement and number it can not assume the status and dignity of a science." Have we not rather forgotten those warning words, and do they not to some extent explain why our universities and learned societies, why the state and statesmen, have turned the cold shoulder on anthropology?

This condition of affairs must not continue; it is good neither for anthropology, nor for the universities, nor for the state if this fundamental science, the science of man, remains in neglect. It will not continue if anthropologists pull together and insist that their problems shall not fail in utility, that their scientific technique shall be up to date, and that anthropological training shall be a reality in our universities—that these shall be fully equipped with museums, with material, with teachers and students.

It is almost as difficult to reform a science as it is to reform a religion; in both cases the would-be-reformer will offend the sacrosanct upholders of tradition, who find it hard to discard the faith in which they have been reared.

But it seems to me that the difficulties of our time plead loudly for a broadening of the purpose and a shapening of the weapons of anthropology. If we elect to stand where we have done a new science will respond to the needs of state and society; it will spring from medicine and psychology, it will be the poorer in that it knows little of man's development, little of his history or pre-history. But it will devote itself to the urgent problems of the day. The future lies with the nation that most truly plans for the future, that studies most accurately the factors which will improve the racial qualities of future generations either physically or mentally. Is anthropology to lie outside this essential function of the science of man? If I understand the recent manifesto of the German anthropologists, they are determined it shall not be so. The war is at an end, but the critical time will be with us again, I sadly fear, in twenty to thirty years. How will the states of Europe stand then? It depends to no little extent on how each of them may have cultivated the science of man and applied its teaching to the improvement of national physique and mentality. Let us take care that our nation is not the last in this legitimate rivalry. The organization of existing human society with a view to its future welfare is the crowning task of the science of man; it needs the keenest-minded investigators, the most stringent technique, and the utmost sympathy from all classes of society itself. Have we, as anthropologists, the courage to face this greatest of all tasks in the light of our knowledge of the past and with our understanding of the folk of to-day? Or shall we assert that anthropology is after all only a small part of the science of man, and retreat to our study of bones and potsherds on the ground that science is to be studied for its own sake and not for the sake of mankind? I do not know what answer you will give to that question, yet I am convinced what the judgment of the future on your answer is certain to be.

Karl Pearson

SULPHUR AS A FERTILIZER

Information concerning the relation of sulphur to plant nutrition and growth has been accumulating during the last decade, and the mass of data has now become so important that it demands recognition of all investigators of nutritional problems. Indeed, it seems to me that much of our past experimental field work dealing with the influence of fertilizer elements upon plants has been so loosely done that we are under the necessity of reexamining the whole matter.

Although the value of sulphur, particularly in the form of gypsum, was recognized at an early period in our national history, the lack of uniform success with it soon led to its neglect as an important fertilizer. And after the invention of acid phosphate about the middle of the last century, the development was almost wholly toward soluble fertilizers containing nitrogen, phosphorus, and potassium. Sulphur was not included as a part of a complete fertilizer, although it was recognized as necessary to plant growth. The soil was thought to contain enough sulphur, and plants to need so little of it, that it was added to the soil only incidentally, as in acid phosphate, potassium sulphate, or ammonium sulphate, along with the three elements forming the so-called "complete" fertilizer.

Experiment station workers and other students of mineral nutrition of plants fell into loose ways of working with fertilizer salts. They have not hesitated to use sulphur-containing nitrogenous compounds when testing the influence of increased nitrogen on plant growth. Similarly the acid phosphate has been used in testing the effects of phosphorus; and potassium sulphate has been used when potassium was under observation. In comparing various forms of fertilizer elements we find the superphosphate for instance pitted against bone meal; or potassium sulphate against potassium chloride; or ammonium sulphate against sodium nitrate as a source of nitrogen. It is evident that such tests as these are all invalid if sulphur itself is shown to be an important fertilizer element. For the ex-

periments have at least two variables, and it would be impossible to ascribe differences in growth to one element with any certainty that the other element was not partly responsible for the result. The recent facts brought out in regard to sulphur should lead at once to a widespread reexamination of these problems, with more rigidly designed and controlled experimentation.

The basic facts brought out are briefly summarized here. In the first place, soil studies have shown that sulphur is one of the rare necessary elements. Soils are generally no richer in sulphur than in the fertilizer elements, nitrogen, phosphorus and potassium. This scarcity of sulphur in normal soils is probably related to the ready leaching of sulphur into drainage water. At the same time improved analytical methods have demonstrated that crop plants require more sulphur than was formerly supposed. They remove it from the soil fully as rapidly as they remove any of the other elements which may become limiting factors. The normal sulphur content of soils is sufficient for from fifteen to seventy crops, provided there are no additions from outside sources, as from rainfall. Even if we count in the rainfall sulphur, it is probable that sulphur is just as often a limiting factor as is phosphorus, or nitrogen, or potassium. For two of the last named elements do not leach as readily as sulphur. The important point is this: If sulphur *is* a limiting factor, addition of any other fertilizer is useless, and a waste, just as much as would be the use of gypsum as a fertilizer if phosphorus were the limiting factor.

Instead of thinking of the N. P. K. formula as representing a "complete" fertilizer it is time we began work solely from the standpoint of limiting factors, including not only these three, but S, Ca, Mg, and any other factors which influence crop production. The early failures with gypsum were probably due to the fact that phosphorus or some other element besides sulphur was limiting growth, or that sulphur at any rate was not the thing needed. These remarks must not be construed as argument for the discontinuance of any of the fertilizer elements now in common use. It would be a grave error to try to replace them with sulphur when they are deficient, but we can no longer ignore sulphur as one of the very important fertilizer elements.

Since the Cruciferæ and Leguminosæ are known to use quantities of sulphur in their metabolism, crop plants of these families must be the ones most likely to suffer from deficiency of sulphur. Recent work by Reimer[1] at the Oregon Agricultural Experiment Station is very significant and deserves the attention of agriculturists and scientists all over the country. He has found that many of the soils of Oregon are deficient in sulphur, and that addition of sulphur-containing compounds of almost any kind may lead to very remarkable increases in the yield of alfalfa or clovers upon such soils. His experiments extended over several years, and involved a variety of soils. The increased production ran from 50 to 1,000 per cent. in alfalfa, with application of such sulphur-containing materials as gypsum, superphosphate, flowers of sulphur, etc. Addition of phosphorus without sulphur had practically no effect, showing that the acid phosphate was valuable only for its sulphur content in this case. The possibility of such increases is a challenge to agriculturists everywhere in these times of under production.

The best results seem to come when the sulphur is used as a top dressing on the legume crop. The usual custom in the United States is to fertilize the cereals, wheat, etc., and allow the legumes to get the effects a year or two later. Sulphur applied in this way does the legume crop little good, for most of it disappears out of the soil by leaching before the legume comes in the rotation. The early successes were most notable when application of the sulphur fertilizer was made directly to the crops most needing it, the legumes. These convert the sulphur into the organic form, and if used as green or stable manures provide sulphur for succeeding crops in a non-leaching form. It seems quite clear that we

[1] Reimer, F. C., "Sulphur as a Fertilizer for Alfalfa in Southern Oregon," Oregon Agr. Coll. Exp. Sta. Bull. 163, 1919.

are applying our sulphur fertilizers at the wrong place in the rotation when we use them with the cereal grains which require little sulphur. Top dressing in legumes would be the logical time in the rotation to provide the sulphur when it is known to be deficient in amount.

While the results obtained by Reimer are certain not to be duplicated on certain types of soils in the eastern United States, as for instance on soils deficient in lime, or on acid soils, the results indicate that it is worth while to test out the value of sulphur generally through the country. The fact that the early users of gypsum over a century ago had similar results with soils in Pennsylvania and Virginia should encourage renewed experimentation with sulphur fertilizers, under conditions that preclude confusing one limiting factor with another. As already suggested, the early failures were probably caused by the soils being deficient in phosphorus rather than sulphur in some cases, or deficient in both at once, or at any rate not in sulphur alone.

We know enough now to make our tests crucial as to which element or elements limit production. The only way we can know the facts will be by actual tests. The system of soil fertility upon which our vast expenditure for fertilizers is based should be examined and tested with open unprejudiced minds. The tests of sulphur containing fertilizers should be made over wide areas in the eastern United States, for there must be many soils in which sulphur is deficient for optimum nutrition of high sulphur-requiring plants. In many cases where superphosphate has been used with success, it may be the sulphur, rather than the phosphorus that is the valuable element. In such cases substitution of the cheaper gypsum might yield as satisfactory results as the more expensive fertilizer.

American agriculture would be vastly benefitted by extensive experimentation along the lines suggested, with strictly controlled conditions under which alone can we have a proper interpretation of results. With our expenditure for fertilizers much in excess of a hundred million dollars annually, it is highly important that our fertilizer practise should be put upon a rational basis at the earliest possible moment.

Charles A. Shull
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ERIC DOOLITTLE

Eric Doolittle, Flower professor of astronomy and director of the Flower Astronomical Observatory died September 21, 1920. In 1917 he was called upon to organize and conduct the U. S. Shipping Board Navigation School at Philadelphia. In attempting to teach the large number of men suddenly thrust upon him and to attend to the correspondence, registration and other necessary details without assistance, none being provided or immediately available, he greatly overtaxed his strength and collapsed under a slight stroke. Although later he was able to resume his university duties, he never fully recovered and did but little observing thereafter. In May, 1920, he became ill again. When his condition became serious he was removed to the University Hospital on June 24, at which place he died.

Professor Doolittle was born in Indiana in 1870. In 1876 his father, C. L. Doolittle, became professor of mathematics and astronomy at Lehigh University. The son graduated there as a civil engineer. After practising this profession for a year he was instructor in mathematics at Lehigh for a year and at the University of Iowa for two years. After spending a year in graduate work in astronomy at the University of Chicago, he became instructor in astronomy at the University of Pennsylvania in 1896, where his father has been called in the meantime as professor of astronomy.

The Flower Observatory was established in 1896. Eric Doolittle was placed in charge of the new 18-inch refractor with its superb Brashear lens. The telescope was made with a long focus, 30 feet, for double star observation. He immediately began his observations of double stars. He used the telescope almost

always when the stars were visible early or late. By day he had classes to meet in class rooms five miles away. For one evening each week the telescope was devoted to visitors. During cloudy weather, between classes and at other odd times he was busy in applying the new method developed by G. W. Hill, for the computation of the secular perturbations of the planets. No constitution could stand this terrific pace. His premature death was the result.

Professor Doolittle's fame rests chiefly upon his observations and discussions of double stars. The publications of the Flower Observatory contain measures of 3,920 double and multiple stars made by him together with the remeasurement of 648 double stars discovered by Hough. Another series of observations is ready for publication. Many discussions of double stars and other subjects are found in the astronomical journals.

In 1913 S. W. Burnham, who had long been recognized as the world's authority upon double stars, feeling that his age no longer permitted him to attend properly to the duties he formerly performed turned over his manuscripts and his library on double stars, a practically complete and priceless collection, to Professor Doolittle, thus placing the mantle of the world's foremost double star astronomer upon him. Burnham's great work "General Catalogue of Double Stars" appeared in 1906. Professor Doolittle has been most faithful to his trust, for in the safe at the Flower Observatory there is a large card catalogue known as the extension of Burnham's General Catalogue. On these cards are found the observations, discoveries and other information relating to double stars which has accumulated since the publication of the General Catalogue. This information is available to those interested. The work will of course go on and be published at some future time.

The results of his computations of secular perturbations were published as the parts were completed in *The Astronomical Journal.* When all the work was done the results were combined and discussed in "The Secular Perturbations of the four Inner Planets" published by the American Philosophical Society, of which he was a member, in 1912. These results were obtained with most painstaking care and are not likely to be superseded for a long time.

He helped to popularize astronomy by editing and himself writing a large part of Vol. IV. of the "Foundation Library" entitled "The Wonderful Universe" and another work which has not yet appeared. He was widely known as the author of a series of popular monthly articles on current astronomical events which have appeared in various magazines and newspapers throughout the country continuously from 1904 until August, 1920.

He was extremely modest, loving simplicity and hating ostentation. His great ability and worth would no doubt have been more widely known and appreciated had he been more of a selfseeker. He was greatly admired and loved by his students, particularly by graduate students. Those who knew him best loved him most.

SAMUEL G. BARTON

SCIENTIFIC EVENTS

AGRICULTURAL WORK OF THE NATIONAL RESEARCH COUNCIL

WITH the advice and assistance of the National Research Council a cooperating group of scientific investigators of insect pests and plant diseases together with representatives of leading industrial concerns engaged in the manufacture of chemicals and appliances used in fighting these enemies of crops has been organized under the name of the Crop Protection Institute. This institute will undertake and support a series of thorough scientific studies of the crop pests themselves and of the means of improving and standardizing the materials and appliances used in fighting them. The Board of Trustees of the institute is composed of nine scientific men representing leading scientific organizations interested in crop protection and four representatives of the manufacturing and commercial interests. The temporary secretary is Mr. Harrison E. Howe, chairman of the Division of Research Extension of the National Research Council.

The annual losses because of the attacks on growing and stored crops by insect pests and plant diseases are enormous despite all that has been done to lessen them. A conservative estimate of the loss of wheat in the United States in a single recent year because of the black stem rust is 180,000,000 bushels, and this pest is but one of the many that attack the wheat every year. What is needed is a combination and concentration of attack on these pests. The new Crop Protection Institute will help to bring this about. It is not intended that the institute will interfere with or duplicate existing efforts now being made by government bureaus, state experiment stations and other agencies to fight crop pests, but that it will introduce a more general cooperation in the work and give special attention to filling important gaps that now exist in it.

The National Research Council has issued a list of references to investigations upon the production of corn and its uses, prepared by M. Helen Keith, of the Illinois Agricultural Experiment Station. The list includes over 1,300 articles which have been published within recent years in this country and abroad. These investigations cover a wide range of problems such as the breeding and growing of corn as affecting its yield and nutritive qualities, the curing of corn and the preparation of silage, the systematic feeding of farm animals, the physiology of corn nutrition, including its relation to pellagra, the chemical composition of corn, and the extraction of such products as iodine, chloroform, oils, alcohol and benzine. Altogether the list shows that the scientific investigation of all phases of corn problems has become exceedingly extended and important.

THE PROPOSED EXPEDITION TO ASIA OF THE AMERICAN MUSEUM OF NATURAL HISTORY

Announcement has been made of an expedition to be sent out by The American Museum of Natural History in cooperation with the American Asiatic Association and *Asia Magazine,* the object of which is to search for the most primitive human remains. It will work for five years in various remote regions of central Asia and will be under the direction and leadership of Mr. Roy Chapman Andrews, associate curator of mammals in The American Museum of Natural History, who for the last ten years has been carrying on zoological explorations in various parts of the Far East. The expedition will be financed by a fund of $250,000, which is being provided by The American Museum of Natural History, The American Asiatic Association and *Asia Magazine,* and the private subscriptions of Mrs. Willard Straight, Messrs. J. P. Morgan, George F. Baker, Childs Frick, W. A. Harriman and Mr. and Mrs. Charles L. Bernheimer.

In the year 1891, a Dutch army surgeon, Eugene Dubois, while excavating for fossils in central Java, discovered near Trinil part of a skull, two molar teeth and a thigh bone. This discovery has been supplemented by that of other indisputably human remains of which the most ancient, found in southern Germany, is the jaw of the so-called Heidelberg man who may be two hundred and fifty thousand years old.

With the exception of the Java specimen, all fossil human fragments have been discovered in Europe or England. It is, however, believed, that whatever light may be thrown upon the origin of man will come from the great Asian plateau.

Leaving about the first of next February, headquarters for the expedition will be established in Peking. The first year will be devoted to studies in paleontology and zoology in China; the second year the work will be carried into Mongolia and a geologist will be added to the field staff; the third, fourth and fifth years archeologists and anthropologists will be sent out who with the zoologists and paleontologists will carry on work in various parts of Asia.

The importance of this region long has been recognized, but no systematic study on a large scale ever has been attempted, and there is no similar area of the inhabited surface of the earth about which so little is known. Whether or not human remains are found it

will yield rich collections in all branches of science.

The material will be exhibited in the proposed Hall of Asiatic Life in The American Museum of Natural History, which it is hoped the city will add to the museum buildings in the near future, and it is hoped that this expedition will make New York the center of Asiatic scientific activity.

The scientific results of the Third Asiatic Expedition will be embodied in a series of volumes that should be, for many years to come, the standard work on the natural history of Central and Eastern Asia, and also in popular books written in non-technical language. Furthermore, the public will be regularly informed of the whereabouts and the activities of the members of the expedition, for articles written in the field will be published in *Asia Magazine*.

Those responsible for the expedition desire to make it a factor in the development of the educational life of the Chinese Republic. China has no institution wherein natural history objects can be studied and exhibited by modern methods and where the scientific work of her own people can be encouraged and directed. It has therefore been decided to invite the Chinese government to cooperate with the expedition in carrying on its work in the Orient. China will be invited to delegate to the expedition certain men who have had already preliminary instruction in various branches of science; under specialists these men, while in the field, will receive training in modern methods of scientific exploration and study.

When the expedition has been completed, it has been agreed to deposit in Peking a duplicate set of the collections, which will form the basis of the Chinese Museum of Natural History. The proposed institution will then have a valuable nucleus of specimens for exhibition and study and a staff of expert Chinese to carry on the work. It will remain for the government to set aside a suitable building where the collections can be housed.

THE THOMAS A. EDISON PRIZE

THE most meritorious research on "The effects of music" submitted to the American Psychological Association before June 1, 1921, will be awarded a prize of $500.

This sum has been placed at the disposal of the association by Thomas A. Edison, Inc. It is the wish of Mr. Edison and his associates to direct attention toward the importance of research in the psychology of music. They point out that we have to-day all too little scientific understanding of the effects, both affective and volitional, which contrasted sorts of musical selections produce on listeners of differing native endowments and training, under varying conditions of mood, season and physical condition.

Researches brought to completion during the present academic year may be submitted in competition for the Thomas A. Edison prize. Manuscripts may be sent at any time before May 31, 1921, to the undersigned, who will transmit them, without the names of the authors, to the members of the committee of award, to be designated by the American Psychological Association. Manuscripts should be submitted in form for publication.

The following topics are suggested as suitable, but the choice of subject is not limited to this list. The committee will welcome any research bearing directly on the nature of music and the way it influences people.

Classification of musical selections according to their psychological effects.
Individual differences in musical sensitivity.
Types of listeners.
Validity of introspection in studying affective responses to music.
Modification of moods by music.
Effects of familiarity and repetition: Emotional durability of various types of selections.
Effects of contrasting types of music on muscular activity.
Other objective (physiological) measurements of effects of musical stimuli.
An experimental study of music as an aid in synchronizing routine factory operations.

The problems proposed for investigation are indeed complex, the conditions extremely vari-

able and difficult of control. But the outcome of painstaking research is promising, both for general psychological theory of the affective processes, and also for our understanding of behavior as influenced by music.

For the Research Department, Thomas A. Edison, Inc.,

W. V. Bingham

Carnegie Institute of Technology,
Pittsburgh, Pa.,
October 13, 1920

THE POPULATION OF THE UNITED STATES

The Bureau of the Census has announced the population of the United States in 1920 as 105,683,108, exclusive of colonial possessions. This shows an increase of 13,710,842 since 1910, or a percentage gain of 14.9. The increase in the previous decade, between 1900 and 1910, was from 75,994,575 to 91,972,266, a percentage gain of 21 and a numerical increase of 15,977,691. The population of outlying possessions will be made public as soon as the figures for Alaska and the military and naval units abroad have been compiled. With these figures included, it is estimated that the colonies have 12,250,000 inhabitants, making the total population of the nation approximately 118,000,000.

The ranking of the states in 1920 and 1910 and their populations for these years, follow:

1920 Rank	State	1920 Pop.	1910 Pop.	1910 Rank
1	New York	10,384,144	9,113,614	1
2	Pennsylvania	8,720,159	7,665,111	2
3	Illinois	6,485,098	5,638,591	3
4	Ohio	5,759,368	4,767,121	4
5	Texas	4,661,027	3,896,542	5
6	Massachusetts	3,851,615	3,366,416	6
7	Michigan	3,667,222	2,810,173	8
8	Missouri	3,463,547	3,293,335	7
9	California	3,426,536	2,377,549	12
10	New Jersey	3,155,374	2,537,167	11
11	Indiana	2,930,544	2,700,876	9
12	Georgia	2,893,955	2,609,121	10
13	Wisconsin	2,631,839	2,333,860	13
14	North Carolina	2,556,486	2,206,287	16
15	Kentucky	2,416,013	2,289,905	14
16	Iowa	2,403,630	2,224,771	15
17	Minnesota	2,386,316	2,075,708	19
18	Alabama	2,347,255	2,138,093	18
19	Tennessee	2,337,459	2,184,789	17
20	Virginia	2,306,361	2,061,612	20
21	Oklahoma	2,027,564	1,657,155	23
22	Louisiana	1,797,798	1,656,388	24
23	Mississippi	1,789,182	1,797,114	21
24	Kansas	1,769,185	1,690,949	22
25	Arkansas	1,750,995	1,574,449	25
26	South Carolina	1,683,662	1,515,400	26
27	West Virginia	1,463,610	1,221,119	28
28	Maryland	1,449,610	1,295,346	27
29	Connecticut	1,380,385	1,114,756	31
30	Washington	1,356,316	1,141,990	30
31	Nebraska	1,295,502	1,192,214	29
32	Colorado	930,376	799,024	32
33	Florida	866,296	752,619	33
34	Oregon	783,285	672,765	35
35	Maine	767,996	742,371	34
36	North Dakota	645,730	577,056	37
37	South Dakota	635,839	583,888	36
38	Rhode Island	604,379	542,610	38
39	Montana	547,593	376,053	40
40	Utah	449,446	373,351	41
41	New Hampshire	443,083	430,572	39
42	Dist. of Columbia	437,571	331,069	43
43	Idaho	431,826	325,594	45
44	New Mexico	360,247	327,301	44
45	Vermont	352,421	355,956	42
46	Arizona	333,273	204,354	46
47	Delaware	223,003	202,322	47
48	Wyoming	194,402	145,965	48
49	Nevada	77,407	81,875	49

SCIENTIFIC NOTES AND NEWS

The autumn meeting of the National Academy of Sciences will be held in Princeton on Monday and Tuesday, November 15 and 16.

Dr. Harmon Northrop Morse, professor of chemistry and director of the chemical laboratory at the Johns Hopkins University, has died at his summer home on Chebeague Island, Me. Dr. Morse was born at Cambridge, Vt., in 1848, and became associate at the Johns Hopkins University in 1876.

King Albert of Belgium has conferred upon Dr. W. W. Keen, of Philadelphia, the honor of "Officer of the Order of the Crown."

Mr. Arthur Gibson has been appointed Dominion Entomologist, and head of the Entomological Branch of the Dominion Depart-

ment of Agriculture, to succeed the late Dr. C. Gordon Hewitt, whose death occurred in February last.

DR. THOMAS F. HUNT, dean of the college of agriculture at the University of California, has been appointed a member of the permanent committee of the International Institute of Agriculture at Rome, Italy.

MR. PAUL MOORE, director of the Information Bureau of the War Trade Board, has been appointed secretary of the Division of Research Extension of the National Research Council.

MR. R. M. WILHELM, chief of the thermometer laboratory of the Bureau of Standards, resigned in September to accept a position with the C. J. Tagliabue Manufacturing Company, of Brooklyn, New York, manufacturers of thermometric apparatus.

ROBERT HALL CRAIG, formerly sanitary engineer with the surgeon general of the army and later sanitary and hydraulic engineer with the Construction Division of the Army, Washington, D. C., and Henry Ward Banks, 3d, formerly research chemist with the Harriman Research Laboratory, New York City, and the National Biscuit Company, have formed a partnership under the name of Banks and Craig, consulting engineers and consulting chemists, with offices in New York City.

THE Iowa Physics Research Board, an organization allied with the Iowa Academy of Science, has been formed as a result of the annual meeting of the Iowa Academy held last May at the University of Iowa, at Iowa City. About twenty-five college physicists are members of the board, which is organized to give mutual help in aiding research work in physics in the state. Three members serve as an executive committee. These are Professor D. W. Morehouse, of Drake University, Profssor Roy D. Weld, of Coe College, and Professor G. W. Stewart, of the University of Iowa. Professor Stewart is the secretary of the committee.

DR. HENRY A. CHRISTIAN, Hersey professor of the theory and practise of physic at the Harvard Medical School, has returned to his position at the medical school and as physician-in-chief of the Peter Bent Brigham Hospital, Boston, after a year's leave of absence spent in Washington as chairman of the Division of Medical Sciences of the National Research Council. From June 25 to July 2, 1920, he delivered five lectures at the University of Washington, Seattle, and he will deliver an address before the Mississippi Valley Medical Association at Chicago, October 27.

DR. EDWARD PHELPS ALLIS, JR., of Palais de Carnolès, Mentone, Maritime Alps, France, well known for his basic researches in comparative anatomy, is now in America, and is expected to spend three or four months in the United States previous to returning to the Allis Laboratory to resume his work.

PROFESSOR C. W. HEWLETT, of the department of physics of the University of Iowa, has returned to the university for the work of the academic year after spending the summer in the research laboratory of the General Electric Company, at Schenectady, N. Y.

HOWARD E. SIMPSON has returned to the chair of geographic geology at the University of North Dakota after a semester's leave of absence. During the leave he served as visiting professor of geology and geography in the University of Southern California.

PROFESSOR HOMER R. DILL, director of the vertebrate museum at the University of Iowa, has returned to the university after spending the summer making collections for the museum in the Hawaiian Islands and in the Billy Goat Pass region of Washington.

A GROUP of twelve physicians of the Mayo Foundation has organized the "Osler Society for the Study of Medical History." Dr. William C. MacCarty, associate professor of pathology, has been chosen president.

COOPERATIVE work has been worked out by Professor Frank Schlesinger, professor of astronomy at Yale University, between the government Observatory at Wellington, New Zealand, and the observatory of Yale University. This plan, which has received the approval of

the university corporation, involves the sending to New Zealand by the university of apparatus to photograph the stars of the southern hemisphere for compiling zone catalogues.

As has been noted in SCIENCE, a special conference was called together by the Royal Society to consider the future of the International Catalogue of Scientific Literature. We learn from *Nature* that the conference held its first meeting at Burlington House on September 28, Sir Joseph Thomson in the chair. The following is the list of delegates: Sir David Prain, Sir Arthur Schuster, Mr. J. H. Jeans, Professor H. E. Armstrong, Dr. F. A. Bather, and Dr. P. C. Mitchell, representing the Royal Society; Professor M. Knudsen, Denmark; M. A. Lacroix, France; Dr. G. van Rijnberk, Holland; Professor R. Nasini and Comm.-Ing. E. Mancini, Italy; Dr. H. Nagaoka, Japan; Mr. R. Laache, Norway; Baron Alströmer, Sweden; Dr. H. Escher, Dr. M. Godet and Dr. H. Field, Switzerland; Dr. R. M. Yerkes, Dr. L. E. Dickson, Mr. L. C. Gunnell and Dr. S. I. Franz, U. S. A.; Sir Henry Hayden and Dr. S. W. Kemp, India; Sir Thomas Muir, South Africa; Sir Edward Parrott, Queensland; Professor E. W. Skeats, Victoria; Mr. C. B. Rushton, Western Australia; and Professor A. Dendy, New Zealand. The delegates were the guests of H. M. Government at a dinner at the Carlton Hotel on September 29.

DR. RAYMOND PEARL, director of the department of biometry and vital statistics, school of hygiene and public health, Johns Hopkins University, Baltimore, will give a course of Lowell lectures in Boston beginning on December 1. The subject is "The Biology of Death," and the subjects of the separate lectures are: (1) Senescence and death; (2) The chances of death; (3) The causes of death; (4) Correlation of death rates; (5) Inheritance of life duration; (6) The trend of mortality and some of its consequences.

THE following course of public lectures on the "History of Science" is being given at Yale University under the auspices of the Gamma Alpha Society: "History of mathematics," Professor E. W. Brown; "History of chemistry," Professor John Johnston; "History of biology," Professor L. L. Woodruff; "History of psychology," Professor R. P. Angier; "History of physics," Professor H. A. Bumstead; "History of geology," Professor H. E. Gregory, and "History of astronomy," Professor Frank Schlesinger.

PRESIDENT E. A. BIRGE, of the University of Wisconsin, gave an address at the dedication of the biological buildings which have been erected at Fairport, Iowa, by the Bureau of Fisheries.

A JOINT meeting of the American Institute of Chemical Engineers, the American Section of the Society of Chemical Industry, the New York Section of the American Chemical Society and the New York Section of the American Electrochemical Society, was held at the Chemists Club in New York City on October 15. The subject of the evening was "Proposed new departures in government chemical work," and the meeting was addressed by Dr. S. G. Cottrell, director of the Bureau of Mines, and Dr. Carl Alsberg, chief of the Bureau of Chemistry, Department of Agriculture.

THE regular October meeting of the Physics Club of Philadelphia is to be held on Friday evening, October 29, at the Randal Morgan Laboratory of the University of Pennsylvania. It will be addressed on the work of the Bureau of Standards by Dr. F. C. Brown, assistant to the director.

DR. RUDOLF EUCKEN, recently retired from the chair of philosophy at the University of Jena and at one time German exchange professor at Columbia University, will give lectures during the winter semester at the University of Helsingfors.

DR. ISADORE DYER, dean of the medical school of Tulane University, known for his work on leprosy and malignant skin diseases, died at his home in New Orleans, on October 12.

THE United States Civil Service Commission announces for November 23, 1920, an open competitive examination for superntendent and director in the Bureau of Fisheries. Two vacancies exist, one for duty at Key

West, Florida, at $1,800 a year, and the other at Beaufort, N. C., at $1,500 a year, each with a possible bonus of $20 a month. Competitors are not required to report for examination at any place, but will be rated on physical ability, education and experience. Further information may be obtained by application to the Civil Service Commission, Washington, D. C.

Natural History, the journal of the American Museum of Natural History, says the largest and most mysterious land animal known in the world to-day has been named *Baluchitherium osborni* by its discoverer, C. Forster Cooper, now curator in the University Museum of Zoology, Cambridge, England. The animal is like neither an elephant, nor a rhinoceros, nor a titanothere, nor a moropus. Mr. Cooper writes that the ankle bone is certainly that of a perissodactyl and seems nearer to the rhinoceros than anything else. A giant primitive rhinoceros tooth, ten centimeters across, has been found, which indicates the presence of rhinoceroses of gigantic size in the Bugti beds of Baluchistan in Oligocene times, which was a strange faunal period. The *Baluchitherium,* if a rhinoceros, certainly had a very long neck, more like that of a gigantic giraffe than that of a horse. Two of the anterior vertebræ of this monster have recently been received in the American Museum and have been compared with all our large land animals, living and extinct, with no result. These neck vertebræ dwarf those of all the largest land animals. The Bugti beds, which have been explored by Cooper and by Pilgrim, also yield a hornless rhinoceros, *Paraceratherium,* in which the lower incisor teeth are turned downward; a hippopotamus that is typical except that it lacks front teeth; and a beautiful anthracothere called *Gelasmodon.* This gives us a glimpse into the still unknown mammalian life of southwest India.

UNIVERSITY AND EDUCATIONAL NEWS

PLANS are now being prepared for a new building for the department of chemistry of Yale University, which has hitherto carried on its work partly in the Kent Chemical Laboratory and partly in the Sheffield Chemical Laboratory. According to present plans, the new building will be located on the Pierson-Sage Square, just north of the Sloane Physics Laboratory. It will have a total floor area of 100,000 square feet; and, in addition to the usual laboratories and recitation rooms, will include an ample number of rooms for research work.

DR. GEORGE BLUMER, who resigned last spring from the deanship of the Yale Medical School, will serve for this year as clinical professor of medicine. Dr. Wilder Tileston will be associated with him with the same title, and Dr. Edward H. Hume, the dean of the medical school of Yale-in-China, who is on leave of absence in this country, will serve as visiting professor of medicine.

DR. G. H. WOOLLETT, of the University of Minnesota, has been elected associate professor of chemistry at the University of Mississippi. Dr. Woollett was formerly connected with the University of Mississippi. Dr. Victor A. Coulter, who served as a gas officer in France, has been elected assistant professor of chemistry in the same institution.

AFTER serving for twenty-five years as head of the department of horticulture and entomology, and eleven years as head of the department of entomology, of Purdue University and Experiment Station, Professor James Troop now relinquishes his position in the experiment station and will devote his time to teaching in the school of agriculture. Professor John J. Davis, formerly with the United States Bureau of Entomology is now head of the department at Purdue.

AT the University of Chicago Dr. Lester R. Dragstet has been appointed assistant professor of physiology and William Berry instructor in psychology.

DR. A. B. MACALLUM, administrative chairman of the Research Council of Canada, has been elected to the new chair of biochemistry

in McGill University, Montreal, to date from October 1. Dr. Macallum will continue his work as chairman of the Research Council until a successor has been named.

Mr. Florian A. Cajori, formerly captain in the food section of the Sanitary Corps and on duty in Jugo-Slavia with the American Relief Administration, has completed his graduate work at Yale University and accepted a position as instructor in physiological chemistry at Leland Stanford, Jr., University, in California.

Professor J. T. Wilson, F.R.S., Challis professor of anatomy in the University of Sydney, has been appointed to the chair of anatomy at the University of Cambridge.

Dr. Wilhelm Wein, professor of physics at Würzburg, has been appointed to succeed Professor Wilhelm Röntgen, who recently retired from the chair of physics at the University of Munich.

DISCUSSION AND CORRESPONDENCE

THE SPECTRUM OF MERCURY VAPOR

To the Editor of Science: In your issue of September 10, Professor C. D. Child calls attention to a greenish glow discharge through mercury vapour whose spectrum shows a continuous band throughout the greater part of the visible spectrum, with the ordinary lines superimposed. This summer, in experimenting on the electrodeless discharge of certain vapors, the writer observed a similar appearance. The method used was one previously employed by Kowalski.[1] A small quantity of mercury was introduced into a highly exhausted Pyrex bulb some 12 cm in diameter. The bulb, surrounded by the primary coil of a Tesla high-frequency outfit, was placed in an electric oven and the appearance of the discharge (if any) observed as the temperature was gradually increased.

In common with Kowalski the writer observed two distinct types of discharge. The first, a dazzling white *ring* discharge occurred at temperatures several degrees above and below 90° C., and showed the ordinary bright line spectrum. The second, a diffuse distinctly greenish glow filling the whole bulb, took place at higher temperatures and was visible until a temperature in the neighborhood of 200° C. was reached. The spectrum of this latter type showed a continuous band with superimposed lines, an appearance similar to that described by Professor Child, but *at the higher temperatures only the line 5461* was visible. The writer's observations agree with those of Kowalski, who compares the appearance he observed with an exactly similar one recorded by A. Kalahne.[2]

Professor Child states that the "radiators" giving rise to the continuous band are uncharged, and suggests that the source of this type of radiation has to do with the formation of clusters of two or three atoms which may be formed when mercury vapor is condensing. Professor Kowlaski ascribes the two appearances noted above to two ionization stages ("Ionisierungsstufe"). It would seem that a possible explanation is the following. At the lower temperatures, because of the greater mean free path, even in the case of an electric field of relatively small intensity, sufficient energy is communicated to an atom on collision to produce ionization. During recombination the line spectrum is emitted. At the higher temperatures, because of the relatively small mean free path (the vapor pressure of mercury at 160° is roughly twenty-five times that at 90°), but little energy is communicated on collision and but little, if any, ionization occurs. The line spectrum accordingly is feeble or absent. Some electrons, however, are displaced from their normal orbits, and in their return to their normal positions, radiation is emitted. Normally such a radiation would also give rise to spectral lines, but we may assume that in the case of the mercury atom with its numerous electrons, the frequent atomic impacts occurring at high temperatures alter the natural periods to such an extent that the emission is continuous over a wide range.

The writer has under way an extended study of the electrodeless discharge of certain

[1] J. Kowalski, *Physik. Zeit.*, 15, 225, 1914.

[2] A. Kalahne, *Wied. Ann.*, 65, 815, 1898.

vapors, and hopes later to publish data on this subject.

JOHN K. ROBERTSON
QUEENS'S UNIVERSITY,
KINGSTON, CANADA

AUTOPSY OF A BLACK FISH

TO THE EDITOR OF SCIENCE: On July 5, 1920, a large female Blackfish, *Globocephalus malas*, a species of whale sixteen feet long came ashore near Woods Hole, Mass., and was brought to the Fish Commission Laboratory at this place for autopsy. The task was new to all present and when a large sac capable of holding a pailful or two was seen near the posterior end of the body, it was at once recognized as probably the empty bladder. This, however, proved to be incorrect for the empty urinary bladder was found near as a hard, flesh-colored organ contracted to the size of a man's large elongated fist. The sac when more closely examined was found to be a recently delivered uterus, completely relaxed, upon the inner surface of which the site of the placenta could be plainly made out and with its open mouthed sinuses capable of receiving the tips of a little finger. This therefore was probably an unique case of death from post-partum hemorrhage, damp bed and absence of a marine accoucheur with his ergot. A few days later the history of the case was completed by the finding of the infant, a youngster about three feet in length, also cast ashore near where the body of the mother was found.

There is no doubt the character of the case would certainly have been undiagnosed had there not been present at the post-mortum, an old general medical practitioner who recognized first that the body of the animal showed an almost exsanguine state, corroborated later by the condition of the relaxed uterus.

G. A. MACCALLUM
WOODS HOLE, MASS.,
July 26, 1920

QUOTATIONS

THE NATIONAL BOTANIC GARDEN

THE plan for the creation of a national Botanic Garden and arboretum that will be comparable with government gardens in other countries, and with public gardens in cities of the United States, should not be allowed to rest. There is force and sound argument in the proposal and no contrary argument. The present national Botanic Garden is national only in its name and in the fact that it is maintained at a slight cost to the nation. It is not national in its exhibit of plant forms. It was a pleasing little spot when the capital was a village. It carries one's thought back to when the mighty Library of Congress was housed in one small room in the Capitol. The Botanic Garden has made little growth in fifty years because it could not expand outside of its tall iron fence. Now the little space within that fence is being dedicated to monuments.

The weight of opinion among government and private botanists and landscape architects is that the Mount Hamilton tract should be the site of the great new and really national Botanic Garden. It fronts on one of the main boulevards. It is already accessible by steam and electric railroads. It adjoins the vast public park which the government is building up from the bottom, the marshes and the margins of the Eastern branch. It thus fits into and becomes a part of the park system. These are among the reasons which botanists urge to bring the matter into public favor. But to them the strong reasons are that in this tract of land are high hills, steep slopes, gentle slopes, thick woods with many varieties of timber, deep ravines, meadows, marshes, brooks and rivulets, and about all kinds of soil which all kinds of American plants pick out for home.

It is a great idea that the United States should have a Botanic Garden of which all Americans could say, "It is the greatest thing of its kind on earth."—Washington *Evening Star*.

A NEW BIOLOGICAL JOURNAL

DURING the past two decades the development of ecological studies in this country has been rapid. Five years ago, as a result of continued and insistent demand, the Ecological Society of America was organized and at once included in its membership botanists

and zoologists of the pure biological sciences, foresters and economic entomologists of the applied sciences, and climatologists and geographers, whose work is closely connected with ecology. Beginning with the study of statics, the description of conditions as they exist, the science progressed rapidly into dynamics, the investigation of the behavior of plants and animals and the development of the communities in which they live. Now, by refined observation and precise experiment, ecology seeks to discover the fundamental causes which control the natural existence of living things. As ecology has broadened in its scope, so also has it deepened; as it has included questions of greater and more fundamental biological importance, so has it attracted investigators in larger numbers and of greater ability; as the products of ecological research have become more numerous and more scholarly, so has the necessity grown for adequate means of publication.

Ecology, the official publication of the Ecological Society of America, is the latest addition to American biological periodicals. Yet it does not add to the number of scientific journals, for it is a continuation of the old and useful *Plant World,* which for several years has been largely ecological. At the St. Louis meeting of the affiliated scientific societies the Plant World Association most generously turned over its magazine, free from all liabilities, to the Ecological Society. But the new title, the new cover, the new volume number, the new editorial board, and above all the opening of its pages to articles on all branches of ecology, stamp it as a distinctly new periodical. *Ecology* begins its career under favorable circumstances. As the official organ of a growing society it is not wholly dependent on a subscription list for its financial stability. It is printed by the New Era Printing Company and managed through the Brooklyn Botanic Garden, the editorial control remaining with the society, undoubtedly fortunate arrangements. Its editorial board, headed by Major Barrington Moore, comprises fifteen men chosen from the leading ecologists of the country and representing a wide diversity of interests and activities.

The first two numbers set a high standard and illustrate the broad scope of the science. The editor-in-chief contributes a short article on the scope of ecology; Ellsworth Huntington correlates atmospheric conditions with the prevalence of influenza and pneumonia; A. E. Douglass describes a new method of correlating tree-growth with precipitation; C. E. Esterly describes experiments on the behavior of a copepod in relation to its diurnal migration; W. E. Praeger contributes a note on the ecology of herons; E. T. Wherry, using his new method of determining soil acidity, discusses the distribution of plants around salt marshes; and J. V. Hoffmann describes the establishment of a Douglas fir forest. In the second number E. B. Powers publishes the results of his experiments on the influence of temperature and concentration on the toxicity of salts to fishes; W. H. Burkholder discusses the effect of soil temperatures on healthy and diseased bean plants; C. C. Forsaith describes the anatomical reduction in alpine plants from the higher White Mountains; and there is presented the first part of an extensive report on the ecology of the plants and animals of Mount Marcy, New York, by Messrs. Adams, Burns, Hankinson, Moore and Taylor, comprising the committee on cooperation of the Ecological Society. From the foregoing it is evident that the first numbers contain material of interest to climatologists, marine biologists, zoologists, botanists, agronomists and foresters as well as to geographers, and even to the medical profession.

Ecology is an illustrated quarterly, octavo; a volume of four numbers will contain 300 or more pages.

H. A. Gleason

SPECIAL ARTICLES

CHROMOSOMAL DUPLICATION AND MENDELIAN PHENOMENA IN DATURA MUTANTS

There are 12 separate and distinct mutants of the Jimson weed (*Datura Stramonium*) which have recurred with more or less fre-

quency in our cultures of this species during the past six years. The majority of these 12 mutants have been already briefly described or figured elsewhere.[1]

The twelve have certain characteristics which distinguish them from the normal stock from which they arose. They are of feebler growth than normals and have a relatively high degree of pollen sterility, while pollen from normals is relatively good with less than 5 per cent. obviously imperfect grains when examined in unstained condition. The breeding behavior of the twelve is peculiar in that the mutant character is transmitted almost entirely through the female sex. Usually about one quarter or less of the offspring only from a given mutant reproduce the parental mutant type. The pollen entirely fails to transmit the mutant character, or transmits it only to a small percentage of its offspring. This is concluded from the fact that normal female plants crossed with mutant pollen produce no mutant offspring or only a small per-- centage, and from the fact that the pollen of any of the 12 mutants seems to be no more potent in reproducing the mutants than pollen from normals.

Another type of mutant, provisionally called "New Species" because of the difficulty or impossibility of crossing it with normals has relatively good pollen and breeds true.

A study has been begun by the present authors of the relationship which exists in *Datura* between the cytological condition and the related phenomena of mutation and Mendelian inheritance. The cytological findings are based on counts of over 350 groups of chromosomes. We can confirm the report of others as to the presence of 12 pairs of chromosomes in the somatic cells of normal jimsons. The somatic number is accordingly twenty-four in contrast to the gametic number twelve. Chromosomal counts from the first division of pollen mother cells show that the gametic number in all the 12 mutants is apparently 12 and 13 giving a calculated somatic number of 25 instead of the 24 found in normals. Whereas in normals all the gametes have 12 chromosomes, in our dozen mutants presumably half the gametes have 12 and half have 13 chromosomes. Apparently in the 13-chromosome gamete the extra chromosome is brought in by a duplication of one of the regular twelve.

The suggestion lies near at hand that each of our 12 mutants is associated with, if not actually determined by, the duplication of a different individual chromosome to make up the calculated total of 25 characteristic of their somatic cells.

If each of our dozen mutants is characterized by the presence of an additional chromosome in a definite one of the 12 chromosome sets, it should be possible by breeding tests to identify the mutant which has as its extra chromosome the one which carries the gene for any particular Mendelian character. This we apparently have been able to do for two of the twelve sets.

The mutant *Poinsettia* (1) which appears to be caused by a duplication of one of the chromosomes carrying determiners for purple or white flower color will serve as an example. *Poinsettia* plants have 2 chromosomes in all the sets except in the one carrying the gene for flower pigmentation, which has three. Considering only the latter, we may have *Poinsettia* mutants, as regards their purple pigment, either triplex PPP, duplex PPp, simplex Ppp or nulliplex ppp.

A duplex purple *Poinsettia* with the formula PPp should, if the chromosomes assort at random, be expected to form egg cells of the following types: $2P + p + pp + 2Pp$. The pollen grains should have the same constitution; but, since the *Poinsettia* character fails to be carried by the pollen to any significant extent, the effective male gametes are $2P + p$. Combining male and female gametes in selfing we expect the following zygotes: $4PP + 4Pp + pp + 2PPP + 5PPp + 2Ppp$. The zygotes with 2 chromosomes in the set are normals, the zygotes with 3 chromosomes are *Poinsettia* mutants. We should have

[1] Blakeslee, A. F., and Avery, B. T., "Mutations in the Jimson Weed," *Jour. of Heredity*, X., 111–120, Figs. 5–15, March, 1919.

therefore among the normals 8 purples to 1 white, and among the Poinsettias 9 purples to no whites. The expectation of an equal number of normals and mutants is practically never realized, probably because of differential mortality in early stages favoring the normals.

A simplex purple heterozygote with the formula Ppp should have the following female gametic formula: P + 2p + 2Pp + pp. Its effective male gametes should be P + 2p Selfing a simplex purple heterozygote therefore should give offspring showing a ratio of purples to whites in normals of 5:4 and in the *Poinsettias* of 7:2. Several *Poinsettia* plants of these two heterozygous purple types have been selfed and found to give color ratios in their offspring in close agreement with the calculated values above. When *Poinsettia* mutants are made heterozygous for the other known Mendelian factors, segregation occurs in normal manner giving the customary 3:1 ratio for the characters involved, in both normals and *Poinsettias*.

Two of the 12 mutants have each a single varietal type, which may be due to factors modifying the expression of the more typical complex. In addition two new mutant forms have arisen each of which in appearance seems to be a combination of two of the typical 12 recurrent mutants. It has not been possible as yet to count their chromosomes nor to study their breeding behavior.

We have discussed the duplication of a single chromosome from only one of the 12 sets, producing mutants with 25 somatic chromosomes, with 3 chromosomes in one set and 2 chromosomes in the other 11. We have obtained in addition the duplication of a single chromosome from each of the 12 sets producing a mutant triploid for all the 12 homologous sets.

The duplication may bring about a doubling of all the chromosomes, producing Gigas-like tetraploid mutants—the "New Species" type already mentioned. Such tetraploid plants have presumably 48 chromosomes in somatic cells and 24 in the gametes. From a study of the color ratios in over eight thousand offspring from tetraploid plants, it is possible to assert with some confidence that independent assortment of the chromosomes in the homologous sets of such tetraploid mutants is the rule. Selfed duplex purple heterozygotes throw 35 purples to 1 white, while the back-cross gives a ratio of 5:1. Simplex purple heterozygotes on the other hand give 3:1 ratios when selfed and 1:1 ratios when back-crossed.

Evidence is at hand which indicates that we may have plants with other of the theoretically possible combinations of chromosomes than those mentioned in the present paper.

The significance of the findings in *Datura* in relation to the peculiarities in inheritance in *Gigas* and other mutant types in *Œnothera* will be pointed out later. It is hoped that it may be possible to publish in the near future a series of more detailed papers on the phenomena of chromosomal duplication in the *Daturas*. The present preliminary publication will suffice to emphasize the distinction which must be kept in mind between chromosomal mutations and mutations affecting only single genes.

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THE AMERICAN CHEMICAL SOCIETY.

DIVISION OF BIOLOGICAL CHEMISTRY

R. A. Gortner, *chairman*

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The fat soluble A. vitamine and xerophthalmia: A. D. Emmett and Marguerite Sturtevant. The authors agree with McCollum that xerophthalmia is a disease which is due primarily to a lack of the fat-soluble A. vitamine. Experiments with rats fed on different planes of nutrition, all with the same precautions as to sanitation, eliminate the idea that xerophthalmia is primarily infectious as Bulley claims. The disease can not be cured by local treatment. It responds quickly to treatment *per os* with extracts containing the fat-soluble A. vitamine. It is not contagious. It is primarily a deficiency disease which in turn may bring about secondary infectious conditions.

Biochemical changes in the flesh of beef animals during partial starvation: C. R. Moulton. Fat

yearling beef steers were subjected to low planes of nutrition. The extreme low plane involved a loss of 81.5 kilos in body weight, or 30 per cent. This included a loss of 44.3 kilos of fat and 10.9 kilos of protein. The total fat in the animal was reduced from 18 to 2 per cent. The skeletal fat even was reduced to 2.9 per cent., showing extreme emaciation. Not only was there a loss in total body protein but the flesh suffered depletion in total nitrogen from 3.58 per cent. to 3.18 per cent., amounting to 10 per cent. of the normal. The water content of the flesh was normal. The soluble nitrogen and albumins were reduced one third. The per cent. of extractive nitrogen was lowered 10 per cent. as was also the concentration per 100 grams water. The relation of extractives to total protein remained constant. A storage of body protein was indicated since the muscle fibers retained their structure and general form.

Scurvy in poultry: J. S. HUGHES and F. E. FOX.

The relation of the vitamine content of feed to the vitamine content of milk produced: J. S. HUGHES and J. B. FITCH.

Studies in embryo-chemistry. (1) The enzymes of the embryonic pancreas. A. Lipase: VICTOR E. LEVINE and EBEN J. CAREY. Pig embryos ranging from 45 to 260 millimeters were employed. The pancreas was removed from the embryo, the total number of organs per litter weighed, triturated and made up with mammalian Ringer solution, the salts of which have an accelerating or activating effect upon lipase. The preparation was centrifuged and the supernatant liquid used. The dilution was such that 1 c.c. was equivalent to 10 mg. tissue. The gall bladder and contents were also removed, ground and diluted with distilled water. Blood was obtained from the umbilical vein. Ethyl butyrate or olive oil was used as substrate. Controls were kept with substrate, enzyme preparation, bile, bile and enzyme, blood, blood and enzyme. After an incubation period of 18 hours at 37.5° C. the flasks were titrated with n/70NaOH, using phenolphthalein as indicator. Titrations with olive oil were made in 50 per cent. alcohol. With an increase in the age of the embryo there was observed not only an increase in the lipolytic activity due to the increased weight of the organ, but also an increased activity per milligram of tissue. The gall bladder showed the presence of bile salts at a very early stage, for striking accelerations in the lipolytic process were demonstrable. The effect of bile salts on lipolysis is far more sensitive a test for these salts than any purely chemical one. Embryonic blood was found to contain an accelerator second in vigor to the bile salts. The increased activity can not be ascribed to an enzyme present in blood, since whole blood or serum after long boiling is still effective. The accelerating substance corresponds to auxo-lipase in the blood of the adult.

A new test for sugar in the urine: VICTOR E. LEVINE. A solution of 2 per cent. sodium tellurite in 10 per cent. sodium carbonate is the reagent employed. The reaction involves the reduction of the tellurite to elemental tellurium. With small amounts of sugar the free tellurium forms a colloidal solution, which is a characteristic brown in direct light and a gray black in reflected light; with large amounts a gray black precipitate of tellurium results. The test is carried out by heating for several minutes 5 c.c. reagent with 1 to 2 c.c. urine. Carbohydrates possessing a free carbonyl group respond to the test. Pentoses (arabinose, rhamnose, xylose); hexoses (glucose, fructose, galactose); dihexoses (lactose, maltose), give positive reactions. Sucrose, raffinose and polysaccharides (cellulose, glycogen, inulin, starch), glycoproteins, nucleoproteins and cerebrosides reduce only after hydrolysis and subsequent neutralization. Aldehydes and ketones do not cause reduction of alkaline tellurite. Formic acid, chloroform, nucleoprotein, thymol, uric acid and creatinine also do not interfere with the test.

Disodium phosphate is a specific catalyst for the quantitative oxidation of glucose to CO_2 with H_2O_2 at 37°: EDGAR J. WITZEMANN. W. Löb (*Biochem. Zt.* 32: 43 (1911)) claimed to have shown by inadequate methods that mixtures of 1/3 M solutions of Na_2HPO_4 and NaH_2PO_4, having the OH ion concentration of normal blood, catalyse the oxidation of glucose with H_2O_2. It was found that glucose, and its transformation products, may be determined quantitatively by oxidizing them to CO_2 with $KMnO_4$ first in hot alkaline solution and afterwards in H_2SO_4 solution. By this method Löb's statements were conclusively proved. Moreover it was shown that the glucose not recovered by the $KMnO_4$ method, after the H_2O_2 oxidation, could be recovered during the oxidation as CO_2. The oxidation of glucose to CO_2 with H_2O_2 at 37° C. in the presence of the phosphate mixture is quantitative. The Na_2HPO_4 is the active compound in the system and in this instance functions as a true oxidizing enzyme without having any other characteristic property of an enzyme. NaOH,

$NaHCO_3$ and Na_2CO_3 alone or in mixtures do not produce this effect. Mixed with Na_2HPO_4 they diminish or destroy its effect.

The standardization of the borax solubility test for commercial casein and its application: Harper F. Zoller. The viscosity of casein in borax solutions shows that the maximum viscosity is obtained at a hydrogen ion concentration of p_H 8.15, while at a p_H of 8.9–9.1 the viscosity is less but constant owing to the buffing effect of borax in this region. The importance of conducting the borax test in this buffered region is discussed. The great variation in the viscosity of casein solutions at different concentrations of casein is utilized in the improved test by choosing a concentration which will bring out the difference in physical constitution of caseins prepared under safe and dangerous temperature conditions. The viscosities of several caseins in borax solutions is given to show that differences in the physical structure of caseins have greater influence upon their viscosity than the normal contaminating substances present in commercial caseins. High temperature caseins always exhibit a comparatively great initial viscosity. The improved casein-borax test is given. The essential changes include low solution temperatures, reduced concentration of casein and increased concentration of borax. These changes are based upon purely physico-chemical relationships. The value of the casein-borax test is defined as an accurate means of differentiating between low and high temperature caseins.

The precipitation of grain curd casein from pasteurized milk including pasteurized sweet cream buttermilk: Harper F. Zoller. The grain curd method can be successfully applied to the separation of casein from pasteurized milks only when higher precipitating temperatures are used. The optimum precipitating temperatures are exhibited in the form of curves for the different observed conditions of pasteurization. The marked differences in the physical nature of the curd from pasteurized and unpasteurized milks are strikingly revealed by the grain curd method of precipitation. Attempts to overcome some of these physical effects by the use of organic acids as precipitants and with coprecipitants are described. The advisability of using rennin to precipitate casein from pasteurized milk is dismissed because of the time required and the large quantity of mineral entrained in the curd. Large centrifugals are urged to wash and press the casein precipitated by the grain curd method from pasteurized and normal milk. The phenomena of the retrogression of the hydrogen ion was discovered in the whey and wash water bathing the curd precipitated from pasteurized milk by the grain curd process at 34° C. This rapid decrease in acidity is attributed to the excessive precipitation of alkaline earth phosphates during pasteurization, and their subsequent resolution at the expense of the hydrogen ion as they are brought into ready contact by the soft dispersing curd. The great check in the rate of this retrogression wrought by using higher temperatures for precipitation is believed to be due to the engulfing of these precipitated phosphates by the firming of the curd; thus the intimate contact between the solution and the phosphates is reduced.

Grain curd casein: Mansfield Clark, Harper F. Zoller, A. O. Dahlberg and A. C. Weimer. To meet the demand for a high-grade commercial casein required in the manufacture of the glue to be used in the construction of aircraft, a controlled method of manufacture was devised and put into larger-scale operation. This method was based primarily upon the properties of casein as an emphoteric electrolyte, the chief control being exercised through the adjustment of the hydrogen ion concentration at which the casein is precipitated and at which it is washed. The casein so produced met the analytical requirements of the government specifications, gave promise of being suitable for the manufacture of a high-grade glue and possessed a uniformity in physical characteristics which would doubtless have eliminated the necessity for troublesome changes in glue formulas. Some laboratory data and certain details of manufacture are presented.

Chlorine as a flu preventive: Harrison Hale. The use of chlorine as a flu preventive when breathed for 5 minutes daily in air containing 43 to 275 parts of chlorine per million was tested at the University of Arkansas, February, 1920. More than 800 treatments were given to 184 different individuals, none of whom developed the flu except one who began to feel sick within a few hours after his first treatment, and whose case seems to have developed previously. The evidence tends to show that chlorine is a preventive, but is not conclusive because of the rapid decrease in the number of flu cases.

The synthesis of lysine in the organism of the white rat: Howard B. Lewis and Lucie E. Root.

Respiration in cereals. The respiration of sprouted wheat. The respiration of rice paddy

and milled rice. The respiration of frosted wheat plants. The respiration of wheat plants infected with stem rust: C. H. BAILEY and A. M. GUJAR.

The etiology of limberneck in fowls: S. D. WILKINS and R. A. DUTCHER. Many theories and beliefs are extant relative to the primary causes of limberneck in poultry. Attempts have been made at the Minnesota Station to produce limberneck by the following methods: (1) Dietary treatment. (2) Feeding and injecting *B. botulinus* and its toxin. (3) Feeding spoiled foods. (4) Feeding salts and brines. (5) Feeding inorganic poisons. (6) Feeding larvæ of certain flies (*Lucilia cæsar*). (7) Feeding maggots from various sources. Negative results were obtained in all trials except when larvæ of *Lucilia cæsar* were fed. These larvæ were obtained from ova deposited on limberneck carcasses.

The relation of vitamines to the development of sex organs in cockerels: S. D. WILKINS and R. A. DUTCHER. White Leghorn cockerels of uniform age and weight were divided into two groups. Group I. received a diet of polished rice only, while Group II. received a diet of polished rice, supplemented by 2 grams of green alfalfa, daily. The testes were found, after 30 days, to have atrophied, in Group I., in spite of the fact that some birds had not lost in weight, showing that atrophy of organs is not necessarily accompanied by general inanition. In Group II. the testes were found to be practically normal for birds of that age and breed.

Effect of vitamine deficiency on various species of animals. I. The production of xerophthalmia in the rabbit: V. E. NELSON and A. R. LAMB. A diet deficient in the fat-soluble vitamine will produce a disease of the eyes of rats which is called xerophthalmia. This condition has been repeatedly produced in rats, and is said to have occurred in children, but has not been reported in any other species. We have begun a study of the relative requirements of various species for this substance. On a ration deficient in fat-soluble A young rabbits grew for a few weeks, but at the end of 60 days lost weight and became nearly blind. Butter-fat effected a cure. It is suggested that herbivorous animals may require more of this vitamine than the rat.

The rôle of vitamines in the growth of yeast. I. Are vitamines essential? E. I. FULMER, V. E. NELSON, F. F. SHERWOOD. Evidence indicates Water Soluble B is unnecessary for yeast growth. Yeast has been growing months in a vitamine free medium at two thirds the rate manifested in wort. Alcoholic extract of alfalfa stimulates growth. Heating the extract with alkali does not destroy this effect. Alcoholic extracted malt gives results like untreated malt. The ammonia content of the medium influences growth. There is an optimum concentration variations from which materially decrease the crop. One is unwarranted stating this or that substance is indispensable until the best synthetic medium is developed.

A correction of two previous papers: 1. Rate of recovery from the action of fluorite rays. 2. Sensitization to heat due to exposure to light of short wave lengths. The graphical representation of hydrogen ion concentration. Notes concerning formol titration of nitrogen: W. P. BOVIE.

CHARLES L. PARSONS,
Secretary

(To be continued)

THE SUMMER MEETING OF THE AMERICAN MATHEMATICAL SOCIETY

THE twenty-seventh summer meeting and ninth colloquium of the American Mathematical Society were held at the University of Chicago on September 7–11. The meeting was preceded on September 6 by a meeting of the Mathematical Association of America and extended over three sessions, lasting until noon on September 8. On the afternoon of that day the colloquium opened. The colloquium consisted of two courses of five lectures each, on "Dynamical Systems" by Professor G. D. Birkhoff, of Harvard University, and on "Topics from the theory of functions of infinitely many variables" by Professor F. R. Moulton, of the University of Chicago. The attendance at the colloquium was eighty-eight, exceeding by nearly twenty the previous record for attendance at a colloquium.

The attendance at the regular sessions of the Society included more than one hundred and twenty persons among whom were nearly one hundred members of the society. One hundred and sixteen persons were present at a joint dinner of the society and the association held on the evening of September 7. Excellent accommodations had been provided at Hitchcock and Beecher Halls, and at the Quadrangle Club, which was most generously put at the disposal of attending members. A resolution expressing to the department of mathematics of the University of

Chicago the society's appreciation and gratitude was unanimously adopted.

Upon recommendation of the council, the society voted to raise the annual dues from five to six dollars and the life-membership fee from fifty to seventy-five dollars. Thirteen new members were elected at this meeting: Dr. R. F. Borden, Brown University; Dr. Tso Chiang, Nan Kai College, Tientsin, China; Professor H. M. Dadourian, Trinity College, Hartford, Conn.; Mr. J. Douglas, Columbia University; Mr. P. Franklin, Princeton University; Mr. C. F. Green, University of Illinois; Captain R. S. Hoar, Ordnance School, Aberdeen, Md.; Professor Jessie M. Jacobs, University of Texas; Mr. E. L. Post, Columbia University; Professor C. D. Rice, University of Texas; Mr. L. G. Simon, New York City; Professor J. E. Stocker, Lehigh University; Mr. Tsao-Shing Yang, Syracuse University. Twenty-one applications for membership in the society were received.

Vice-president Richardson presided at the sessions of Tuesday and Wednesday forenoons; Professor M. W. Haskell presided on Tuesday afternoon. The following thirty-four papers were read at this meeting:

On the projective generation of cyclides: Arnold Emch.

A generalization of the strophoid: J. H. Weaver.

On the relative distribution of the real roots of two real polynomials: C. F. Gummer.

The polyadic expansion of a number: A. A. Bennett.

On the location of the roots of the jacobian of two binary forms: J. L. Walsh.

On the transformation of convex point sets: J. L. Walsh.

On Kakeya's minimum area problem: W. B. Ford.

On completely continuous linear transformation: T. H. Hildebrandt.

Integral equations in which the kernel is quadratic in the parameter: Anna J. Pell.

Annihilators of modular invariants: Olive C. Hazlett.

Construction of multiple correspondences between two algebraic curves: Virgil Snyder and F. R. Sharpe.

Note on a method of proof in the theory of Fourier's series: Dunham Jackson.

On the drift of spinning projectiles: J. W. Campbell.

Functions of infinitely many variables in Hilbert space: W. L. Hart.

A property of continuity: D. C. Gillespie.

Periodic orbits of type 2/1: L. A. Hopkins.

Note on the median of a set of numbers: Dunham Jackson.

An application to Weierstrass's function of the generalized derivative of type (C1): C. N. Moore.

A method of graduating curves: L. R. Ford.

Note on a generalization of a theorem of Baire: E. W. Chittenden.

On classes of functions defined in terms of relatively uniform convergence: E. W. Chittenden.

On the relation between the Hilbert space and the calcul functionnel of Fréchet: E. W. Chittenden.

A generalization of the Fourier cosine series: J. L. Walsh.

Note on a class of polynomials of approximation: Dunham Jackson.

Reciprocal subgroups of an abelian group: G. A. Miller.

Characteristic lines of transformations: E. R. Hedrick, L. Ingold and W. D. A. Westfall.

Pseudo-differentiation of a summable function: W. L. Hart.

Five notes on Einstein's theory of gravitation: Edward Kasner.

On the convergence of certain trigonometric approximations: Dunham Jackson.

Note on the Picard method of successive approximations: Dunham Jackson.

Symbolic notation in the theory of modular invariants: Olive C. Hazlett.

On the Fourier coefficients of a continuous function: T. H. Gronwall.

A sequence of polynomials connected with the n-th root of unity: T. H. Gronwall.

Upper bounds of the coefficients in conformal mapping: T. H. Gronwall.

Arnold Dresden,
Acting Secretary

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